Spring 2018

Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada

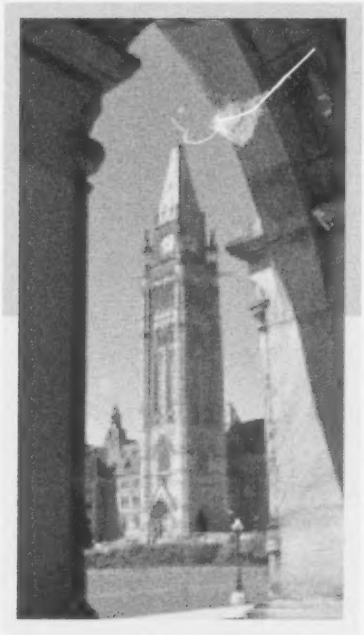
Independent Auditor's Report

REPORT 1

Salmon Farming

Office of the Auditor General of Canada

Bureau du vérificateur général du Canada



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Performance audit reports

This report presents the results of a performance audit conducted by the Office of the Auditor General of Canada under the authority of the *Auditor General Act*.

A performance audit is an independent, objective, and systematic assessment of how well government is managing its activities, responsibilities, and resources. Audit topics are selected based on their significance. While the Office may comment on policy implementation in a performance audit, it does not comment on the merits of a policy.

Performance audits are planned, performed, and reported in accordance with professional auditing standards and Office policies. They are conducted by qualified auditors who

- establish audit objectives and criteria for the assessment of performance,
- gather the evidence necessary to assess performance against the criteria,
- report both positive and negative findings,
- conclude against the established audit objectives, and
- make recommendations for improvement when there are significant differences between criteria and assessed performance.

Performance audits contribute to a public service that is ethical and effective and a government that is accountable to Parliament and Canadians.

The Report is available on our website at www.oag-bvg.gc.ca.

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Introduction

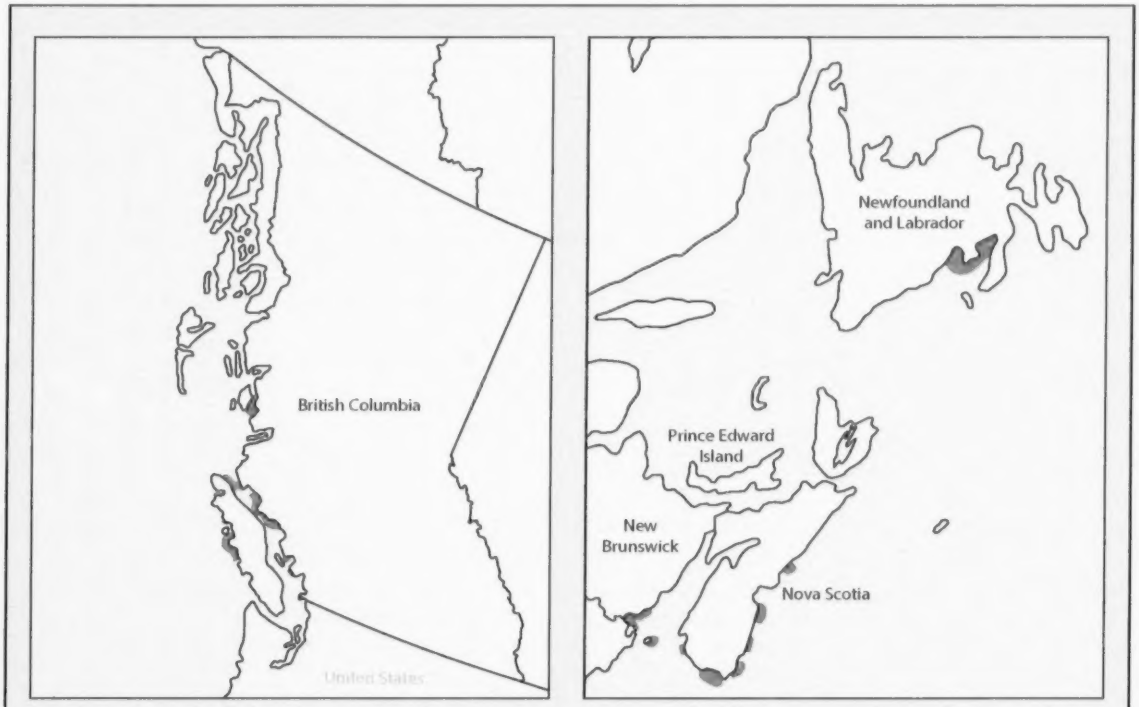
Background

Salmon farming in Canada

1.1 Salmon farming, also referred to as salmon aquaculture, is the farming of salmon for commercial purposes. In Canada, it is carried out primarily along the coasts of British Columbia and the Atlantic provinces (Exhibit 1.1). In 2016, the salmon aquaculture industry in Canada was valued at $1 billion.

1.2 Canada is the fourth largest producer of farmed salmon after Norway, Chile, and the United Kingdom. The Canadian salmon farming industry is considered to have significant potential for growth due to Canada's long coastline, cold water temperatures, and proximity to the United States market.

Exhibit 1.1 **Salmon farms are concentrated in areas along the coasts of British Columbia and the Atlantic provinces**

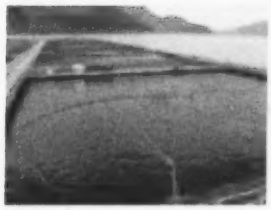


Source: Based on information provided by Fisheries and Oceans Canada; the New Brunswick Department of Agriculture, Aquaculture and Fisheries; and the Newfoundland and Labrador Department of Fisheries and Land Resources.

Salmon account for most finfish aquaculture in Canada.

1.3 Most of the salmon farmed in Canada, on both the Atlantic and Pacific coasts, are Atlantic salmon. Companies generally grow young salmon in land-based freshwater hatcheries before transferring them to net-pen farms in the ocean, where they are raised to maturity. Because of the density of fish in the pens, companies must take preventative measures to address the increased risk of disease from naturally occurring pathogens (that is, disease-causing agents such as parasites and viruses). To control diseases, companies use drugs and pesticides as required.

1.4 Aquaculture operations, along with overfishing, pollution, and climate change, can pose risks to wild fish. Federal and provincial governments regulate aquaculture activities to mitigate these risks, which include pathogen transfer between farmed and wild fish, drugs and pesticides flowing out of net pens and into the ocean, and fish escapes. Fish that escape from net pens can spread disease to wild fish and have negative genetic impacts on them (exhibits 1.2 and 1.3).



Adult salmon are primarily raised in net pens in the ocean.

1.5 An alternative to net-pen aquaculture in the ocean is the use of closed-containment systems on land. These systems limit interactions with the external aquatic environment, reducing the risk of pathogen transfer between farmed and wild fish. They also limit the risk of fish escaping. However, they remain energy-intensive and expensive to build. As a result, they are generally used to raise young fish, which are then transferred to net pens in the ocean to grow to full size.

Exhibit 1.2 **Salmon net-pen aquaculture interacts with the environment**

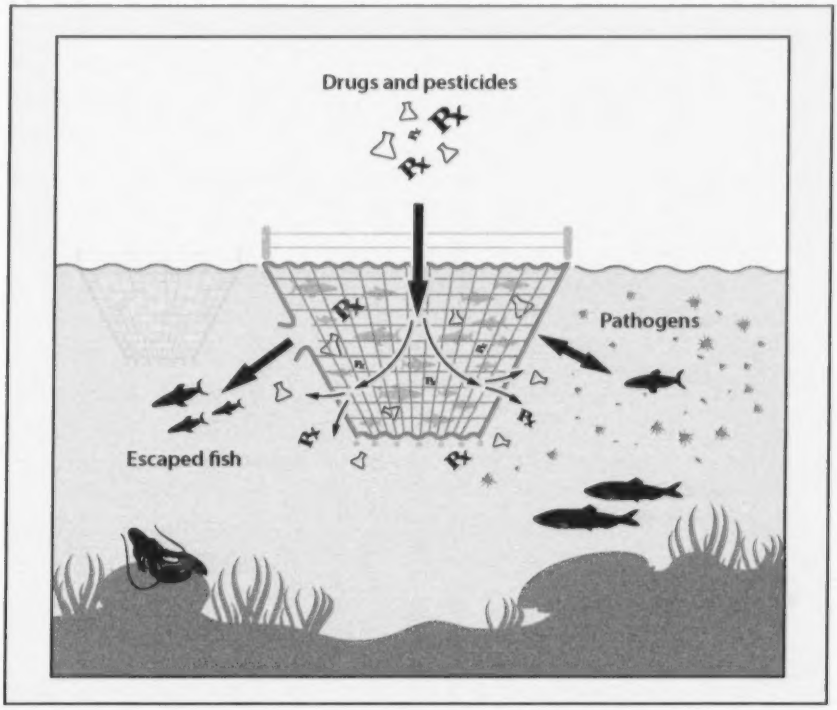


Exhibit 1.3 **Infectious diseases and parasites can affect farmed and wild salmon**

As in cattle, poultry, and other livestock farming, disease management is critical in salmon farming. Infectious diseases and parasites in farmed fish are not known to affect human health, but they can affect farmed salmon and wild fish, including wild salmon.

Photo: © Stan Proboszcz, Watershed Watch Salmon Society

Infestations of sea lice, a parasite that attaches itself to fish (see photo), have also been a problem in both Atlantic and Pacific regions. Sea lice from wild fish can infect farmed salmon by spreading rapidly in net pens. Juvenile wild salmon that migrate close to these net pens can then be infected, making them more vulnerable to disease and predators.

Infectious diseases and parasites can be prevented and controlled through several means, including vaccines, drugs, pesticides, and assessment of the health of salmon before their transfer to net pens.

1.6 Wild salmon is especially important to Canada's Indigenous peoples, who depend on it for food, social, and ceremonial purposes. It also has ecological importance, providing food for other animals. Several wild salmon stocks are currently classified as endangered on both the Atlantic and Pacific coasts, making their protection even more important.

Roles and responsibilities

1.7 The regulations for the Canadian finfish aquaculture industry are set by both federal and provincial governments, and they differ by region. In British Columbia, the federal government is responsible for issuing operating licences, approving sites, establishing requirements, and monitoring compliance with the *Pacific Aquaculture Regulations*. In most Atlantic provinces, provincial governments are responsible for most aspects of aquaculture management.

1.8 Fisheries and Oceans Canada (the Department) is the federal entity with the primary responsibility for regulating aquaculture. The Department is also responsible for conserving and protecting fish and fish habitat. As part of this, the Department has in place wild salmon conservation policies for both the Atlantic and Pacific coasts. In the 2016–17 fiscal year, it spent $25 million on its aquaculture programs.

1.9 The Canadian Food Inspection Agency (the Agency) is responsible for preventing the spread of infectious diseases that can affect farmed and wild fish. This responsibility includes controlling the import and export of aquatic animals. The Agency spends over $5 million annually on this program.

1.10 Both the Department and the Agency have responsibilities related to Canada's international commitments. In 2015, Canada committed to achieving the United Nations' 2030 Agenda for Sustainable Development, including promoting conservation and the sustainable use of oceans, seas, and ocean resources (Goal 14). In addition, Canada developed the 2020 Biodiversity Goals and Targets for Canada, based on the Aichi Biodiversity Targets under the United Nations' Convention on Biological Diversity. The Canadian targets included a commitment to managing aquaculture sustainably under a science-based regime.

1.11 In addition, as a member country of the United Nations World Organisation for Animal Health, Canada has committed to evaluating and addressing diseases of aquatic animals that can be spread by international and domestic trade and that can significantly affect farmed and wild aquatic animal populations.

Previous audits

1.12 In our 2004 audit on the progress made by Fisheries and Oceans Canada in conserving and protecting salmon stocks, we reported knowledge gaps related to the potential effects of salmon aquaculture on wild stocks, the need to prioritize research, and weaknesses in approving aquaculture sites and enforcing regulations. The current audit does not constitute a direct follow-up audit because significant regulatory changes have occurred since 2004. These changes include the transfer of responsibility for most aspects of aquaculture management in British Columbia from the provincial government to the Department in 2010, and the coming into force of the *Aquaculture Activities Regulations* in 2015.

Focus of the audit

1.13 This audit focused on whether Fisheries and Oceans Canada and the Canadian Food Inspection Agency managed the risks associated with salmon aquaculture in a manner that protected wild fish.

1.14 This audit is important because salmon aquaculture is a growing industry in Canada that provides an important source of fish, given declining wild fish stocks. Globally, aquaculture now provides half of all fish for human consumption. Raising farmed salmon in net pens in the ocean has potential effects on wild fish that need to be understood and addressed, as appropriate.

1.15 In this audit, we did not examine other finfish, shellfish, or aquatic plant aquaculture. We did not audit the role of Health Canada in regulating drugs and pesticides, or other federal organizations with a role in regulating aquaculture. We also did not examine regulation at the provincial level. We did not examine the safety of farmed fish for human or animal consumption. Farmed fish, like wild fish, are subject to federal regulations

and inspections to ensure their safety in this regard. Finally, we did not look at aquaculture in Nova Scotia, because it was recently audited by the Nova Scotia Auditor General, or in Prince Edward Island, which has no net-pen salmon aquaculture.

1.16 More details about the audit objective, scope, approach, and criteria are in **About the Audit** at the end of this report (see pages 19–21).

Findings, Recommendations, and Responses

Studying the effects of salmon farming on wild fish

Fisheries and Oceans Canada had not made sufficient progress in completing risk assessments for key diseases

Overall message

1.17 Overall, we found that Fisheries and Oceans Canada had not made sufficient progress in completing risk assessments for key diseases, which were required to assess the effects of salmon farming on wild fish.

1.18 This finding matters because the Department committed to conducting scientific studies and assessments to understand the effects of aquaculture on wild fish.

1.19 Our analysis supporting this finding presents what we examined and discusses the following topics:

- Research funding
- Gaps in scientific research

Context

1.20 Scientific research is critical to assessing the risks of aquaculture, such as the transfer of pathogens between farmed fish and wild fish, the effects of drugs and pesticides on farmed and wild fish, and the consequences of fish escapes from net pens. Researching the effects of aquaculture on wild fish was one of the recommendations in 2012 of the Cohen Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River. The report noted that if by 2020 net-pen aquaculture was found to pose more than a minimal risk of serious harm to migrating salmon in one key area of British Columbia, Fisheries and Oceans Canada should prohibit salmon farms from operating in that area.

1.21 In 2015, the federal government committed to implementing the recommendations of the Cohen Commission. In 2016, the Senate Standing Committee on Fisheries and Oceans also called for more research on the effects of aquaculture on wild fish. In response, the Department indicated that it would identify further research needed

to assess the potential risks posed by a variety of diseases and pathogens that are present in farmed salmon.

Recommendation

1.22 Our recommendation in this area of examination appears at paragraph 1.28.

Analysis to support this finding

1.23 **What we examined.** We examined whether the Department carried out research on the effects of aquaculture on wild fish. We looked at the Department's efforts with respect to aquaculture operations in British Columbia, New Brunswick, and Newfoundland and Labrador.

1.24 **Research funding.** We found that the Department had several aquaculture research programs in place. For example, it provided partial funding to the Strategic Salmon Health Initiative, a multi-year program to examine the potential causes of diseases in both farmed and wild salmon. The balance of the funding for this initiative was provided by non-governmental organizations.

1.25 The Department also identified potential stressors from aquaculture activities on wild fish and their habitat, such as the release of pathogens, deposits of drugs and pesticides, and fish escapes, and it focused its research on these areas. However, we found that it provided only short-term funding for research focused on informing policy and management decisions. In contrast, the Department provided long-term funding for collaborative research to advance the sustainable aquaculture industry. In our view, the Department needs to provide long-term funding for research on the effects of aquaculture activities on wild fish.

1.26 **Gaps in scientific research.** The Department conducted research on interactions between farmed and wild fish. Among the topics researched were

- the effects of disease and parasite transmission,
- the effects of drugs and pesticides, and
- genetic interactions between farmed and wild Atlantic salmon in Atlantic Canada.

Despite this research, we found that some knowledge gaps remained in these areas. Further, we found that the Department was not monitoring wild fish health. The Department was aware that additional work in these areas was needed to reduce uncertainty and ensure adequate oversight of the aquaculture industry.

1.27 We also found that the Department had completed only 1 of the 10 risk assessments of key diseases that it had committed to completing by 2020 to evaluate the consequences of disease transfer from aquaculture operations to wild fish. At the time of our audit, the Department had a plan to complete the remaining 9 risk assessments by 2020.

1.28 **Recommendation.** Fisheries and Oceans Canada should conduct its planned disease risk assessments by 2020 to increase its knowledge of the effects of aquaculture on wild salmon, as it committed to doing in its response to the Cohen Commission report.

The Department's response. *Agreed. Fisheries and Oceans Canada will deliver disease risk assessments, as planned, by the September 2020 deadline specified in the Cohen Commission report. This is an important analysis and initiative that will deliver on aquaculture-related recommendations made by Justice Cohen, and it is aligned with delivering on the Minister's mandate letter.*

Preventing the spread of infectious diseases and parasites

Some measures to address disease risks in aquaculture management were not yet in place

Overall message

1.29 Overall, we found that although Fisheries and Oceans Canada and the Canadian Food Inspection Agency had put in place some measures to mitigate the spread of infectious diseases and parasites from farmed salmon, key elements were missing. For example, Fisheries and Oceans Canada's program for auditing the health of farmed salmon in British Columbia was out of date, and the Department had limited laboratory capacity to provide timely surveillance test results. In addition, the Department and the Agency had not clarified roles and responsibilities for managing emerging disease risks to mitigate the potential impacts of salmon farming on wild fish.

1.30 The Department had also not clarified how it was using the precautionary approach to manage aquaculture.

1.31 This finding matters because diseases and parasites present in salmon farms in the ocean may pose a risk to wild fish.

1.32 Our analysis supporting this finding presents what we examined and discusses the following topics:

- Disease controls for aquaculture operations in British Columbia
- Disease controls for aquaculture in Canada
- Use of the precautionary approach in managing aquaculture

Context

1.33 Fisheries and Oceans Canada has a framework of regulations in place to control infectious diseases in aquaculture. The *Fishery (General) Regulations* include conditions for releasing or transferring living fish in net-pen facilities. In British Columbia, the *Pacific Aquaculture Regulations* give the Department authority to issue licences for companies to operate net-pen salmon farms in the ocean.

1.34 The Canadian Food Inspection Agency's mandate is to ensure animal health and food safety, including fish, and to support the international trade of animals and food. Under the *Health of Animals Act* and its regulations, the Agency has the authority to take measures to prevent the introduction and spread of diseases in both farmed and wild fish. These measures include undertaking surveillance to declare whether a disease is present or absent in an area, allowing or prohibiting the movement of fish between areas where the status of a disease is different, and responding to outbreaks.

1.35 The Department is also responsible for providing diagnostic disease testing services to the Agency through its network of aquatic animal health laboratories.

Recommendations

1.36 Our recommendations in this area of examination appear at paragraphs 1.46 and 1.50.

Analysis to support this finding

1.37 **What we examined.** We examined whether Fisheries and Oceans Canada had measures in place to prevent and control infectious diseases and pathogens in salmon farms where it had this authority. We also looked at whether the Canadian Food Inspection Agency met its requirement to implement measures to prevent the introduction and spread of infectious diseases in salmon farms across Canada.

1.38 **Disease controls for aquaculture operations in British Columbia.** We found that the Department established conditions for the location and expansion of aquaculture sites to ensure that farms were best located to reduce aquaculture risks. For example, as had been recommended by the Cohen Commission, the Department prohibited new sites and expansions in one area of British Columbia where many salmon farms were located, due to the number of wild salmon migrating through this area.

1.39 The Department also imposed conditions on the operation of salmon farms in British Columbia. For example, aquaculture companies had to monitor and control diseases and parasites, and to record the number of fish placed in net pens, the number of deaths during the growing cycle, and the number of fish harvested. If the number of deaths exceeded a certain limit, the companies had to notify the Department.

1.40 To verify compliance with these conditions, the Department conducted fish health audits and sea lice inspections on salmon farms in British Columbia. Although it noted high compliance with licensing conditions, the Department acknowledged that it might not have been addressing the most important fish health issues, such as the detection of new and emerging diseases. The audit program had not been updated since 2006. In addition, the Department had not analyzed trends in

diseases and parasites. During the course of our audit, the Department conducted a review of its audit program and planned to make changes as appropriate.

1.41 **Disease controls for aquaculture in Canada.** The Canadian Food Inspection Agency and Fisheries and Oceans Canada co-delivered the National Aquatic Animal Health program to prevent and control the spread of disease. Under this program, the Agency had the lead role for activities such as monitoring the presence of disease and ordering the destruction of diseased fish. In 2016, the Agency also became responsible for controlling the movement of fish between provinces. Before 2016, only Fisheries and Oceans Canada had this responsibility.

1.42 For the areas we examined, we found that the Agency managed its responsibilities in terms of disease control for salmon aquaculture in a manner consistent with its mandate to protect fish across Canada. It certified whether areas where net-pen salmon farms were located were free of disease, and it set conditions for the movement of fish to prevent the spread of disease. It focused on a set of diseases based on a list of criteria established by the World Organisation for Animal Health. The criteria included trade importance and the potential to negatively affect significant wild fish populations.

1.43 However, we found that the Department and the Agency did not have a formal process to share information about aquatic animal health. Agency officials noted that they shared information with Department officials at headquarters, but that this was not always transmitted to Department staff in the regions. In our view, information sharing was critical to ensure that the Agency and the Department were working together effectively to control the disease risks associated with aquaculture.

1.44 At the time of our audit, the Department planned to transfer to the Agency responsibility for controlling risks related to the movement of live fish. This transfer would be limited to diseases the Agency was already regulating. We found that the Department had not formally assessed whether this change would create gaps in the protection of wild fish. For example, the Department and the Agency had not clarified their respective roles and responsibilities for managing emerging diseases, which created the risk that potential emerging diseases affecting farmed and wild salmon would not be adequately addressed.

1.45 Finally, we found that the Department had limited laboratory capacity to provide timely surveillance test results to the Agency so that the Agency could make timely decisions on disease control. In some cases, the Department provided test results to the Agency one year after samples had been taken.

1.46 **Recommendation.** Fisheries and Oceans Canada and the Canadian Food Inspection Agency should clarify their roles and responsibilities for managing emerging disease risks to mitigate the potential impacts of salmon farming on wild fish.

The Department's response. *Agreed. Fisheries and Oceans Canada will continue to work collaboratively with the Canadian Food Inspection Agency, the federal lead for managing diseases of both farmed and wild fish, to clarify roles and responsibilities for managing emerging diseases and agree on the most efficient and effective method for sharing information on fish health. The Department will work with the Agency to establish a formal process to discuss, assess, and share information on emerging diseases of interest to either government entity. This process will help to clarify the government response and framework for the assessment of risk for emerging diseases to mitigate any potential impacts to wild fish. This formal process will be implemented by April 2019.*

The Agency's response. *Agreed. The Canadian Food Inspection Agency will work with Fisheries and Oceans Canada to develop and document a formal process to discuss and evaluate emerging diseases of concern to either government entity and decide which entity will assume which role or responsibility with regard to such diseases in order to protect wild fish. Technical staff in the Agency and the Department will engage in the development of such a process during the 2018–19 fiscal year, with implementation by April 2019.*

1.47 **Use of the precautionary approach in managing aquaculture.** In its Aquaculture Policy Framework, the Department committed to applying the "precautionary approach" to decision making. This approach ensured that when there were threats of serious or irreversible damage to wild fish, lack of full scientific certainty would not be used as a reason for postponing measures to protect them.

1.48 However, the Department had not clarified how it would apply the precautionary approach in its management of aquaculture. For example, it had not set limits or thresholds for when to take action if it observed declines in wild fish stocks in areas where aquaculture was prevalent. To respond to such declines, the Department would have to consider the potential effects of aquaculture along with those of other stressors, such as climate change and overfishing.

1.49 In our view, a clear explanation of how the Department applied the precautionary approach was especially important, given its commitment to advancing aquaculture, as stated in the Aquaculture Policy Framework. Without this explanation, the Department was vulnerable to claims that it prioritized the development of the aquaculture industry over the protection of wild fish.

1.50 **Recommendation.** Fisheries and Oceans Canada should determine and communicate how it applies the precautionary approach to managing aquaculture when there is uncertainty about the effects of aquaculture on wild fish. The Department should also clearly articulate the level of risk to wild fish that it accepts when enabling the aquaculture industry.

The Department's response. *Agreed. Fisheries and Oceans Canada will continue to apply the precautionary approach according to the Government of Canada's framework on precaution. The Department applies the precautionary approach where appropriate, as a subcomponent within an overall decision-making approach, to deal with risks of serious or irreversible harm even with significant scientific uncertainty. Even when a particular activity is deemed "low" risk, lack of full scientific certainty shall not be used to postpone mitigation measures to prevent further potential environmental degradation. The Department will clearly communicate how it applies the precautionary approach to management decisions (for example, on the Department's website).*

To support this, the Department conducts research to characterize how individual species, populations, and communities respond to a range of stressors, including aquaculture. This research informs management decision making concerning establishment or refinement of thresholds to protect at-risk ecosystem functions and valued components.

The Department will further explore options, building on best practices in the current pathway of effects framework, to more clearly articulate, by March 2019, how precaution and the application of risk assessments inform departmental decision making.

Controlling the effects of drugs and pesticides

Fisheries and Oceans Canada had not assessed the effectiveness of its rules for depositing drugs and pesticides at salmon farms to minimize harm to wild fish

Overall message ➔

1.51 Overall, we found that Fisheries and Oceans Canada did not conduct adequate analysis to know whether its rules for drug and pesticide deposits at salmon farms would minimize harm to wild fish. In addition, the Department did not define limits on the amount of drugs or pesticides that could be deposited, or confirm the accuracy of information self-reported by aquaculture companies.

1.52 This finding matters because drugs and pesticides used in aquaculture operations can harm wild fish, especially those living on the ocean floor.

1.53 Our analysis supporting this finding presents what we examined and discusses the following topics:

- Regulating deposits of drugs and pesticides
- Reducing drug and pesticide resistance
- Validating self-reporting on drug and pesticide deposits

Context

1.54 The *Aquaculture Activities Regulations* authorize and control deposits of drugs and pesticides into the ocean by aquaculture companies. The companies use pesticides and drugs such as antibiotics to treat diseases and parasites in farmed fish. Although Health Canada is responsible for regulating drugs and pesticides and their use, Fisheries and Oceans Canada also plays a role in minimizing harm to wild fish from drug and pesticide deposits, in accordance with the *Fisheries Act*. Drugs and pesticides can affect wild salmon and other fish species, especially those living on the ocean floor.

Recommendations

1.55 Our recommendations in this area of examination appear at paragraphs 1.61 and 1.63.

Analysis to support this finding

1.56 **What we examined.** We examined whether the Department had controls in place to ensure that wild fish were protected from the effects of the drugs and pesticides used by the aquaculture industry.

1.57 **Regulating deposits of drugs and pesticides.** We found that when it developed the *Aquaculture Activities Regulations*, the Department had not assessed whether the regulations were adequate to minimize the harm to wild fish that could result from the use of drugs and pesticides. The regulations offered limited protection for wild fish, such as requiring companies to consider reducing their use of drugs and pesticides—for example, by using vaccines or nutritional supplements.

1.58 While aquaculture companies were required to comply with the conditions of veterinarian prescriptions and pesticide labels, we found that the Department did not define thresholds for excessive drug or pesticide deposits into net pens. It also did not assess whether rules were needed to control the cumulative effects of drug or pesticide deposits at multiple sites in an area. Exposure to multiple treatments or to several consecutive treatments increases the risk of harm to wild fish.

1.59 We also found that the Department did not require companies to monitor the ocean floor under net pens after they had deposited drugs or pesticides to determine whether fish, including lobsters, were harmed. Therefore, the Department did not know the extent to which drug and

pesticide deposits affected wild fish. At the time of our audit, the Department was initiating a science review to better understand the effects of drugs and pesticides, including their cumulative effects.

1.60 **Reducing drug and pesticide resistance.** We found that the Department did not require companies to use other options, such as early harvesting of fish, when there was a high risk of resistance developing. Drug and pesticide resistance reduces the effectiveness of the tools available to control diseases and parasites.

1.61 **Recommendation.** Fisheries and Oceans Canada should establish thresholds for the deposit of drugs and pesticides into net pens to more effectively minimize harm to wild fish.

The Department's response. *Agreed. Fisheries and Oceans Canada will undertake further analysis and continue to work with its provincial and territorial partners, Environment and Climate Change Canada, and Health Canada to improve the protections provided by the* Aquaculture Activities Regulations.

The ongoing interdepartmental science review will provide advice on options for post-deposit monitoring of drugs and pesticides. This advice will inform planned regulatory changes to the Aquaculture Activities Regulations, *beginning in 2020, as well as the need to develop and establish national thresholds.*

Further, a "traffic light" decision tree will be developed by March 2020 to help address the potential cumulative impacts on wild fish from the deposit of pesticides and drugs into fish-bearing waters. In partnership with Health Canada and Environment and Climate Change Canada, Fisheries and Oceans Canada will be in a better position to determine under which oceanographic conditions pesticides should no longer be deposited ("red light"), areas and conditions under which risks are acceptable ("green light"), and areas where the use of such products need to be more carefully studied and controlled ("yellow light").

1.62 **Validating self-reporting on drug and pesticide deposits.** The *Aquaculture Activities Regulations* required industry to self-report the amount, type, and timing of its deposits of drugs and pesticides. We found that the Department did not validate self-reported information and had not determined how it could do this. It planned to use these reports to assist it in evaluating the effects of drugs and pesticides on wild fish, in order to refine its rules for depositing drugs and pesticides. Accurate data was therefore critical.

1.63 **Recommendation.** Fisheries and Oceans Canada should develop and implement an approach to validate the accuracy of information that aquaculture companies report regarding their drug and pesticide deposits.

The Department's response. *Agreed. Fisheries and Oceans Canada will perform an analysis and costing exercise by March 2019 to determine options for a risk-based auditing program, which would enable it to effectively validate information provided by aquaculture companies so the Department can confirm the use of drugs and pesticides. These options will be considered in future program redesign.*

Controlling fish escapes

Fisheries and Oceans Canada did not set a national standard for nets and other equipment to prevent fish escapes

Overall message

1.64 Overall, we found that Fisheries and Oceans Canada had not set a national standard for the quality and maintenance of equipment, such as nets and anchoring systems, to reduce the risk of fish escapes.

1.65 This finding matters because preventing fish escapes is important to minimize the risk of causing negative genetic effects in wild salmon. This is especially important in Atlantic Canada, where escaped farmed salmon have begun to interbreed with declining wild salmon populations.

1.66 Our analysis supporting this finding presents what we examined and discusses the following topic:

- Preventing fish escapes

Context

1.67 Fisheries and Oceans Canada has overall responsibility under the *Fisheries Act* to protect fish. In British Columbia, under the *Pacific Aquaculture Regulations*, the Department is responsible for ensuring that aquaculture companies have measures in place to prevent escapes. In New Brunswick and Newfoundland and Labrador, approval for anchoring nets and other equipment to the seabed falls under provincial jurisdiction.

1.68 When farmed fish escape, they can negatively affect wild salmon stocks by interbreeding with wild salmon of the same species, which may weaken the ability of the wild salmon to avoid predators and forage for food. Escaped fish may also spread disease and compete with wild fish for food.

1.69 Fish escapes range from those involving a small number of fish during the transfer in and out of nets to those involving up to hundreds of thousands of fish when nets or structures become extensively damaged. For example, in 2015, only a few farmed fish were reported to have escaped in British Columbia, while 40,000 farmed salmon were reported to have escaped in Atlantic Canada.

Recommendation

1.70 Our recommendation in this area of examination appears at paragraph 1.74.

Analysis to support this finding

1.71 **What we examined.** We examined whether the Department had standards in place to prevent fish escapes.

1.72 **Preventing fish escapes.** We found that in British Columbia, the Department required aquaculture companies to follow its standard for net support structures and anchoring systems, and to properly maintain equipment.

1.73 In New Brunswick and Newfoundland and Labrador, the Department did not have a standard for net support structures and other aquaculture equipment because the provinces were responsible for licensing aquaculture operations. However, the number of salmon reported to have escaped from farms along the Atlantic Coast remained high, partly as a result of the exposure of net pens to the effects of severe storms. In our view, the Department has a role in ensuring that farmed salmon escapes in Atlantic Canada are prevented.

1.74 **Recommendation.** Fisheries and Oceans Canada should initiate discussions with its counterparts in the Atlantic provinces to address the quality and maintenance of equipment on salmon farms to prevent fish escapes.

The Department's response. *Agreed. Fisheries and Oceans Canada will work with provincial and territorial regulatory partners, as well as international colleagues (for example, Norway), to explore national standards considering current expertise and experience within the aquaculture domain. This type of regulatory work is currently not addressed by existing programs within the Department and will require the development of program capacity in collaboration with provincial and territorial partners.*

Through a feasibility study, the Department will initiate federal, provincial, and territorial discussions by December 2019 and study and potentially develop national standards regarding equipment quality and maintenance.

Enforcing and reporting on compliance

Fisheries and Oceans Canada did not adequately enforce compliance with regulations to minimize harm to wild fish

Overall message

1.75 Overall, we found that the Department did not sufficiently enforce its *Aquaculture Activities Regulations* to minimize harm to wild fish. It also did not always publish detailed or up-to-date information about such matters as disease outbreaks.

1.76 This finding matters because enforcement is important to ensuring that aquaculture companies are complying with regulations designed to protect wild fish. Publishing information about disease outbreaks and compliance with regulations is important to building public confidence in government regulation of the industry.

1.77 Our analysis supporting this finding presents what we examined and discusses the following topics:

- Enforcing regulations
- Reporting on industry practices and compliance

Context

1.78 Fisheries and Oceans Canada is responsible for ensuring that the aquaculture companies comply with the *Pacific Aquaculture Regulations* and the related licensing conditions in British Columbia and the *Aquaculture Activities Regulations* across Canada in order to minimize harm to fish and fish habitat.

1.79 In its Aquaculture Policy Framework, the Department committed to public reporting of aquaculture-related information to build public confidence in how it regulates the industry.

Recommendations

1.80 Our recommendations in this area of examination appear at paragraphs 1.85 and 1.88.

Analysis to support this finding

1.81 **What we examined.** We examined whether the Department enforced compliance with regulations to protect wild fish from the effects of aquaculture in British Columbia, New Brunswick, and Newfoundland and Labrador. We also examined whether it was meeting its commitments to report publicly on industry practices and compliance.

1.82 **Enforcing regulations.** Department officials told us that when the *Aquaculture Activities Regulations* came into force in 2015, no additional officers were needed to enforce these regulations, despite the increased workload. We found, however, that additional resources were needed in New Brunswick and Newfoundland and Labrador.

1.83 Because there were no enforcement officers dedicated to aquaculture in these regions, enforcement officers responsible for wild fisheries added aquaculture to their responsibilities. At the time of our audit, the Department was initiating training to give officers the skills required for enforcing aquaculture regulations, such as determining whether companies deposited illegal drugs and pesticides into net pens. However, without dedicated enforcement officers, the Department was unable to effectively enforce the *Aquaculture Activities Regulations* in these provinces. One indication of this lack of enforcement was the fact that despite concerns regarding potential non-compliance, the Department had not laid any charges related to salmon aquaculture under the *Aquaculture Activities Regulations*.

1.84 In British Columbia, the Department had few measures available to address non-compliance with the *Pacific Aquaculture Regulations*. Enforcement officers could provide information to educate the company or could issue a warning letter. The Department rarely used the more severe response of taking a company to court. We noted that the Department's regulations did not include enforcement measures such as giving tickets (including fines) to companies for non-compliance, even though Department officials told us that they considered ticketing an effective enforcement option. Limitations in enforcement capacity for the *Aquaculture Activities Regulations* and in the tools available to enforce the *Pacific Aquaculture Regulations* made it difficult for the Department to effectively deter non-compliance.

1.85 **Recommendation.** Fisheries and Oceans Canada should more effectively enforce aquaculture regulations and pursue additional enforcement measures.

The Department's response. *Agreed. Fisheries and Oceans Canada will conduct an aquaculture-enforcement costing exercise by November 2019 to determine the full operational implications of enforcing aquaculture regulations in Canada.*

An internal evaluation in 2015 recommended that the Department examine expected efficiencies associated with an expanded ticketing regime. As a result, an initial phase was approved to take a more consistent approach to minor fisheries offences by the commercial and recreational sectors. Further information on Phase Two of the process can be found on the Department's website.

The Department is currently working to expand and update its ticketing regime so that aquaculture regulations are addressed.

1.86 **Reporting on industry practices and compliance.** We found that in British Columbia, the Department published industry statistics on diseases and parasites, and on compliance with the *Pacific Aquaculture Regulations*. However, this information was not always up to date, and in some cases, it did not contain adequate detail. For example, 2014 was the last year for which the Department reported detailed information on disease outbreaks at sites that required treatment.

1.87 The *Aquaculture Activities Regulations* required aquaculture companies to report to the Department annually, starting in April 2016, on the drugs and pesticides they deposited. However, at the time of our audit, the Department had not yet determined the level of detail it would publish about these deposits. In our view, information that is not sufficient, specific, or up to date can reduce public confidence that the Department is effectively regulating the industry.

1.88 **Recommendation.** Fisheries and Oceans Canada should provide timely public reports with detailed information on companies' drug and pesticide deposits, and on the health of farmed fish in British Columbia.

The Department's response. *Agreed. Fisheries and Oceans Canada will continue to provide compliance information for use in production of the aquaculture compliance index as part of the Canadian Environmental Sustainability Indicators.*

In addition, the Department is currently examining options to publicly report information collected as part of the Aquaculture Activities Regulations, *including mitigation measures used to reduce the impact on fish and fish habitat. These options will be finalized by June 2018.*

Conclusion

1.89 We concluded that Fisheries and Oceans Canada did not adequately manage the risks associated with salmon aquaculture consistent with its mandate to protect wild fish. Although the Department had some measures to control the spread of infectious diseases and parasites to wild fish in British Columbia, it had not made sufficient progress in completing the risk assessments for key diseases that were required to understand the effects of salmon aquaculture on wild fish. It also had not defined how it would manage aquaculture in a precautionary manner in the face of scientific uncertainty. Moreover, the Department did not adequately enforce compliance with aquaculture regulations to protect wild fish.

1.90 The Canadian Food Inspection Agency had measures to prevent the introduction and spread of infectious diseases with respect to aquaculture. However, the Department and the Agency had not clarified roles and responsibilities for managing emerging diseases. This lack of clarification created a risk that potential emerging diseases affecting wild salmon would not be adequately addressed.

About the Audit

This independent assurance report was prepared by the Office of the Auditor General of Canada on the oversight of salmon aquaculture. Our responsibility was to provide objective information, advice, and assurance to assist Parliament in its scrutiny of the government's management of resources and programs, and to conclude on whether the oversight of salmon aquaculture complied in all significant respects with the applicable criteria.

All work in this audit was performed to a reasonable level of assurance in accordance with the Canadian Standard for Assurance Engagements (CSAE) 3001—Direct Engagements set out by the Chartered Professional Accountants of Canada (CPA Canada) in the CPA Canada Handbook—Assurance.

The Office applies Canadian Standard on Quality Control 1 and, accordingly, maintains a comprehensive system of quality control, including documented policies and procedures regarding compliance with ethical requirements, professional standards, and applicable legal and regulatory requirements.

In conducting the audit work, we have complied with the independence and other ethical requirements of the relevant rules of professional conduct applicable to the practice of public accounting in Canada, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality, and professional behaviour.

In accordance with our regular audit process, we obtained the following from entity management:

- confirmation of management's responsibility for the subject under audit;
- acknowledgement of the suitability of the criteria used in the audit;
- confirmation that all known information that has been requested, or that could affect the findings or audit conclusion, has been provided; and
- confirmation that the audit report is factually accurate.

Audit objective

The objective of this audit was to determine whether Fisheries and Oceans Canada and the Canadian Food Inspection Agency managed risks associated with salmon aquaculture consistent with their respective mandates to protect wild fish.

Scope and approach

The federal organizations included in this audit were Fisheries and Oceans Canada and the Canadian Food Inspection Agency. We included the Canadian Food Inspection Agency because it has a mandate to prevent the introduction and spread of infectious disease. We excluded other federal organizations that play a role in regulating aquaculture.

The audit focused on the federal oversight of salmon aquaculture in three provinces: British Columbia, New Brunswick, and Newfoundland and Labrador. These provinces have the highest salmon aquaculture production.

We gathered audit evidence by reviewing documents; interviewing federal officials, industry representatives and third-party stakeholders, and members of Indigenous communities; reviewing files; and visiting selected aquaculture facilities.

We did not examine shellfish and aquatic plant aquaculture, nor did we examine the effects of salmon diseases and parasites on human health, salmon enhancement programs used to increase the number of wild fish, or imports and exports of fish eggs and fish. We also did not look at the production and consumption of genetically modified salmon.

Criteria

Criteria	Sources
To determine whether Fisheries and Oceans Canada and the Canadian Food Inspection Agency managed risks associated with salmon aquaculture consistent with their respective mandates to protect wild fish, we used the following criteria:	
Fisheries and Oceans Canada's approval of new, relocated, or expanded aquaculture sites in British Columbia is consistent with its regulatory mandate to protect wild fish and their habitat, in accordance with the precautionary approach.	• Canada's Policy for Conservation of Wild Pacific Salmon, Fisheries and Oceans Canada, 2005 • Canada's Policy for Conservation of Wild Atlantic Salmon, Fisheries and Oceans Canada, 2009 • Fisheries and Oceans Canada's Update on the Implementation of the Cohen Commission Recommendations, 2016 • *Oceans Act* • Prime Minister's Mandate Letter to the Minister of Fisheries, Oceans and the Canadian Coast Guard, 2015
Fisheries and Oceans Canada has put in place and enforced measures to prevent and control infectious diseases and pathogens in aquaculture facilities, in accordance with the precautionary approach.	• 2016–17 Report on Plans and Priorities, Fisheries and Oceans Canada • Fisheries and Oceans Canada's Update on the Implementation of the Cohen Commission Recommendations, 2016 • National Code on Introductions and Transfers of Aquatic Organisms, Fisheries and Oceans Canada, 2013
The Canadian Food Inspection Agency has used a risk-based approach supported by science to prevent the introduction and spread of infectious diseases between Canadian watersheds.	• Aquatic Animal Health Code, World Organisation for Animal Health, 2016 • 2016–17 Report on Plans and Priorities, Canadian Food Inspection Agency • National Code on Introductions and Transfers of Aquatic Organisms, 2013 • Statement of Values, Canadian Food Inspection Agency

Criteria	Sources
To determine whether Fisheries and Oceans Canada and the Canadian Food Inspection Agency managed risks associated with salmon aquaculture consistent with their respective mandates to protect wild fish, we used the following criteria: (continued)	
Fisheries and Oceans Canada has monitored and enforced the appropriate use of drugs and pesticides by aquaculture facility operators.	• Agreement on the Application of Sanitary and Phytosanitary Measures, World Trade Organization, 1998 • *Fisheries Act* • *Pacific Aquaculture Regulations* • *Aquaculture Activities Regulations* • Memorandum of Understanding Regarding Cooperation in the Implementation of Pollution Prevention Provisions of the *Fisheries Act*, Fisheries and Oceans Canada, Environment Canada, and Health Canada, 2015
Fisheries and Oceans Canada uses science in making regulatory decisions on aquaculture in accordance with the precautionary approach.	• 2016–17 Report on Plans and Priorities, Fisheries and Oceans Canada • Fisheries and Oceans Canada's Update on Implementation of the Cohen Commission Recommendations, 2016
Fisheries and Oceans Canada has put in place and enforced measures to address salmon escapes from aquaculture facilities, including monitoring whether escapes are occurring and responding to escape events.	• National Code on Introductions and Transfers of Aquatic Organisms, Fisheries and Oceans Canada, 2013 • *Pacific Aquaculture Regulations* • Canada's Policy for Conservation of Wild Pacific Salmon, Fisheries and Oceans Canada, 2005 • Williamsburg Resolution, North Atlantic Salmon Conservation Organization, 2003

Period covered by the audit

The audit covered the period between June 2015 and October 2017. This is the period to which the audit conclusion applies.

Date of the report

We obtained sufficient and appropriate audit evidence on which to base our conclusion on 21 December 2017, in Ottawa, Canada.

Audit team

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List of Recommendations

The following table lists the recommendations and responses found in this report. The paragraph number preceding the recommendation indicates the location of the recommendation in the report, and the numbers in parentheses indicate the location of the related discussion.

Recommendation	Response
Studying the effects of salmon farming on wild fish	
1.28 Fisheries and Oceans Canada should conduct its planned disease risk assessments by 2020 to increase its knowledge of the effects of aquaculture on wild salmon, as it committed to doing in its response to the Cohen Commission report. **(1.24–1.27)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will deliver disease risk assessments, as planned, by the September 2020 deadline specified in the Cohen Commission report. This is an important analysis and initiative that will deliver on aquaculture-related recommendations made by Justice Cohen, and it is aligned with delivering on the Minister's mandate letter.
Preventing the spread of infectious diseases and parasites	
1.46 Fisheries and Oceans Canada and the Canadian Food Inspection Agency should clarify their roles and responsibilities for managing emerging disease risks to mitigate the potential impacts of salmon farming on wild fish. **(1.41–1.45)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will continue to work collaboratively with the Canadian Food Inspection Agency, the federal lead for managing diseases of both farmed and wild fish, to clarify roles and responsibilities for managing emerging diseases and agree on the most efficient and effective method for sharing information on fish health. The Department will work with the Agency to establish a formal process to discuss, assess, and share information on emerging diseases of interest to either government entity. This process will help to clarify the government response and framework for the assessment of risk for emerging diseases to mitigate any potential impacts to wild fish. This formal process will be implemented by April 2019. **The Agency's response.** Agreed. The Canadian Food Inspection Agency will work with Fisheries and Oceans Canada to develop and document a formal process to discuss and evaluate emerging diseases of concern to either government entity and decide which entity will assume which role or responsibility with regard to such diseases in order to protect wild fish. Technical staff in the Agency and the Department will engage in the development of such a process during the 2018–19 fiscal year, with implementation by April 2019.

Recommendation	Response
1.50 Fisheries and Oceans Canada should determine and communicate how it applies the precautionary approach to managing aquaculture when there is uncertainty about the effects of aquaculture on wild fish. The Department should also clearly articulate the level of risk to wild fish that it accepts when enabling the aquaculture industry. **(1.47–1.49)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will continue to apply the precautionary approach according to the Government of Canada's framework on precaution. The Department applies the precautionary approach where appropriate, as a subcomponent within an overall decision-making approach, to deal with risks of serious or irreversible harm even with significant scientific uncertainty. Even when a particular activity is deemed "low" risk, lack of full scientific certainty shall not be used to postpone mitigation measures to prevent further potential environmental degradation. The Department will clearly communicate how it applies the precautionary approach to management decisions (for example, on the Department's website). To support this, the Department conducts research to characterize how individual species, populations, and communities respond to a range of stressors, including aquaculture. This research informs management decision making concerning establishment or refinement of thresholds to protect at-risk ecosystem functions and valued components. The Department will further explore options, building on best practices in the current pathway of effects framework, to more clearly articulate, by March 2019, how precaution and the application of risk assessments inform departmental decision making.
Controlling the effects of drugs and pesticides	
1.61 Fisheries and Oceans Canada should establish thresholds for the deposit of drugs and pesticides into net pens to more effectively minimize harm to wild fish. **(1.57–1.60)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will undertake further analysis and continue to work with its provincial and territorial partners, Environment and Climate Change Canada, and Health Canada to improve the protections provided by the *Aquaculture Activities Regulations*. The ongoing interdepartmental science review will provide advice on options for post-deposit monitoring of drugs and pesticides. This advice will inform planned regulatory changes to the *Aquaculture Activities Regulations*, beginning in 2020, as well as the need to develop and establish national thresholds. Further, a "traffic light" decision tree will be developed by March 2020 to help address the potential cumulative impacts on wild fish from the deposit of pesticides and drugs into fish-bearing waters. In partnership with Health Canada and Environment and Climate Change Canada, Fisheries and Oceans Canada will be in a better position to determine under which oceanographic conditions pesticides should no longer be deposited ("red light"), areas and conditions under which risks are acceptable ("green light"), and areas where the use of such products need to be more carefully studied and controlled ("yellow light").

Recommendation	Response
1.63 Fisheries and Oceans Canada should develop and implement an approach to validate the accuracy of information that aquaculture companies report regarding their drug and pesticide deposits. **(1.62)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will perform an analysis and costing exercise by March 2019 to determine options for a risk-based auditing program, which would enable it to effectively validate information provided by aquaculture companies so the Department can confirm the use of drugs and pesticides. These options will be considered in future program redesign.
Controlling fish escapes	
1.74 Fisheries and Oceans Canada should initiate discussions with its counterparts in the Atlantic provinces to address the quality and maintenance of equipment on salmon farms to prevent fish escapes. **(1.72–1.73)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will work with provincial and territorial regulatory partners, as well as international colleagues (for example, Norway), to explore national standards considering current expertise and experience within the aquaculture domain. This type of regulatory work is currently not addressed by existing programs within the Department and will require the development of program capacity in collaboration with provincial and territorial partners. Through a feasibility study, the Department will initiate federal, provincial, and territorial discussions by December 2019 and study and potentially develop national standards regarding equipment quality and maintenance.
Enforcing and reporting on compliance	
1.85 Fisheries and Oceans Canada should more effectively enforce aquaculture regulations and pursue additional enforcement measures. **(1.82–1.84)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will conduct an aquaculture-enforcement costing exercise by November 2019 to determine the full operational implications of enforcing aquaculture regulations in Canada. An internal evaluation in 2015 recommended that the Department examine expected efficiencies associated with an expanded ticketing regime. As a result, an initial phase was approved to take a more consistent approach to minor fisheries offences by the commercial and recreational sectors. Further information on Phase Two of the process can be found on the Department's website. The Department is currently working to expand and update its ticketing regime so that aquaculture regulations are addressed.
1.88 Fisheries and Oceans Canada should provide timely public reports with detailed information on companies' drug and pesticide deposits, and on the health of farmed fish in British Columbia. **(1.86–1.87)**	**The Department's response.** Agreed. Fisheries and Oceans Canada will continue to provide compliance information for use in production of the aquaculture compliance index as part of the Canadian Environmental Sustainability Indicators. In addition, the Department is currently examining options to publicly report information collected as part of the Aquaculture Activities Regulations, including mitigation measures used to reduce the impact on fish and fish habitat. These options will be finalized by June 2018.

Spring 2018

Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada

The Commissioner's Perspective

1. Salmon Farming
2. Canada's Preparedness to Implement the United Nations' Sustainable Development Goals
3. Conserving Biodiversity